PROPOSED USE OF THE PLENARY POWERS TO SUPPRESS THE GENERIC NAMES *ORTHOCEROS* BRUUNICH, 1771, AND *ORTHOCERA* MODEER, 1789, SO AS TO STABILISE THE GENERIC NAME *ORTHOCERAS* BRUGUIERE, 1789 (CLASS CEPHALOPODA, ORDER NAUTILOIDEA). Z.N.(S.) 44

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Part 1. Historical Survey

The present report is based on a draft prepared some years ago by Mr. Francis Hemming, late Secretary to the Commission, in response to a request addressed to him by the Commission at their Paris (1948) meeting. On that occasion, the Commission agreed (*Bull. zool. Nomencl.* **4** : 307–310) to render an Opinion (eventually Opinion 236, *Ops. Decls. Int. Comm. zool. Nomencl.* **4** : 329–342) stating that the generic names published by Brünnich (M.T.), 1771, in his *Zoologiae Fundamenta* are available names under the Code. At the same time, it was agreed to defer a decision on the status of the name *Orthoceros* Brünnich, 1771, pending consultations with palaeontologists. The question of the status of Brünnich's work had been put to the Commission by the late Mr. R. Winckworth (*Bull. zool. Nomencl.* **1** : 113–117), but the particular problem discussed here had been brought before the Commission in a slightly different form as long ago as 1930 by Dr. A. K. Miller (now of University of Iowa, Iowa City, Iowa, U.S.A.). The first part of the present paper (paragraphs 1 to 18) describes the history of the case in the Commission's office since the receipt of Dr. Miller's application and is of historical interest as showing how progressive improvements in the Rules have increased the power and flexibility of the means at the Commission's disposal for dealing with complicated issues. Concrete proposals for .dealing with the situation now disclosed are put forward in the later part of the report.

2. In his communication, Dr. Miller pointed out that the name *Orthoceras* had been for many years generally in use for an extinct group of long, straight, nautiloid cephalopods and attributed to Breynius, 1732. Apart from the fact that this author's work is not available for use in zoological nomenclature (having been published before 1758), the name which he used was not *Orthoceras* but *Orthoceratites*. This latter name was also used by Gesner in 1758 (a non-binominal author) to denote both nautiloid cephalopods and *Nodosaria*-like foraminifera with straight, elongate shells. The first author to publish *Orthoceras* as an available name was Bruguière (1789 ; *Ency. méth., Hist. nat. Vers*, pt. i : xvi) as follows: " ORTHOCÉRATE.—Orthoceras. Coquille conique, composée de cloisons transverses, & d'une gouttière sur un des côtés, l'ouverture fermée par un opercule." No species were then included in the genus, but (according to Dr. Miller) Bory de St. Vincent in 1824 (*Tabl. ency. méth., Helminth. ou vers infusoires, etc.*) listed "*Orthocera raphanus* Lamk. VII. 593 " and "*Orthocera legumen* Lamk. VII. 595 " and these species are figured in Plate

465 of Lamarck's *Tabl. ency. méth.*, etc. as *Nautilus raphanus* and *Nautilus legumen* respectively. Dr. Miller also stated that in 1799 and 1822 Lamarck applied the generic names *Orthocera* and *Orthoceratites* to foraminifera. The position was, therefore, that a generic name in constant general use in nautiloid cephalopods should have been applied to foraminifera, not only in the spelling *Orthoceras*, but also in the closely similar spellings *Orthocera* and *Orthoceratites*, and Dr. Miller asked " whether the rules should be rigidly followed in this case, or whether the Commission should be asked to establish a cephalopod type for *Orthoceras*, since the name has become so deeply embedded in cephalopod literature ".

3. Dr. Miller's case had not been put before the Commission for a ruling at the time when Mr. Hemming became Secretary to the Commission in 1936, and it was not found possible to complete it before the outbreak of war in 1939. In 1944, Mr. Hemming re-opened the case and came to the conclusion that, on the data presented by Dr. Miller in 1930, the only means whereby the name *Orthoceras* could be validated for a genus of cephalopods would have been by the suppression, under the Plenary Powers, of *Orthoceras* Bruguière, 1789 (as applied to a genus of foraminifera) and all subsequent uses of that name prior to its first use in an available sense for a genus of cephalopods. Apart, however, from the difficulty of establishing by whom, when and where the name had been so applied, there was the possibility that, by the date in question, some other generic name might have been published for the same cephalopod taxon, in which case that other name would also have had to be suppressed in order to validate the accustomed use of *Orthoceras*. Alternatively, the Commission might have been asked to designate a cephalopod species to be the type-species of *Orthoceras* Bruguière, 1789, but clearly very strong grounds would have been needed to justify the use of the Plenary Powers to transfer a nominal genus from one phylum to another while retaining its original authorship and priority.

4. Mr. Hemming had therefore begun to look about for some other method of dealing with Dr. Miller's problem when the submission of the late Mr. Winckworth's application in relation to the status of the generic names in Brünnich's *Zoologiae Fundamenta* seemed to offer the possibility of a new approach. Brünnich used the generic name *Orthoceros* (not *Orthoceras*) for a genus of cephalopods, and since he referred no species to any of his genera, their respective type-species fell at that time to be determined in accordance with the principles laid down in Opinion 46. Pending a decision by the Commission on the general question of the availability of Brünnich's generic names, Mr. Hemming enquired of interested specialists whether they would accept a solution of the problem which involved the adoption of the name *Orthoceros* as the name to be used for the group of species generally, but as it then appeared incorrectly, referred to by the name *Orthoceras*.

5. In August 1944, Mr. Hemming therefore wrote further to Dr. Miller and also sought the advice of Dr. C. J. Stubblefield (Geological Survey & Museum, London) and the late Dr. L. F. Spath, with the results set out below.

6. Dr. Stubblefield drew attention in his reply (dated 1 September 1944) to two important developments in the case which had not come to the notice

of the Commission. The first was a paper by Miller (A.E.), Dunbar (C.O.) & Condra (G.E.) (1933, *Bull. Nebraska Geol. Surv.* (2) **9** : 58–65) where the status of *Orthoceras* was discussed and illustrated. The second was a paper by Miller & Teichert (C.) (1936, *Amer. J. Sci.* **31** : 352–362) in which they concluded that " no species had ever been referred to *Orthoceras* that comes ' under the generic description as originally published ' and therefore none can be chosen as genotype " (: 353–354). They therefore rejected Miller, Dunbar & Condra's designation of *Orthoceratites regularis* Schlotheim, 1820 as the type-species, and pointed out that the conservation of *Orthoceras* for a genus of cephalopods, while desirable on grounds of usage, would involve the suppression of five valid uses of that name. They then stated a case for the adoption of *Orthoceros* Brünnich, 1771 for the genus in question, and suggested that *Orthoceratites regularis* Schlotheim might be chosen as its type-species. They did not think it either " necessary or desirable " to change the spelling to *Orthoceras* (: 360). They stated further that Bruguière's description of *Orthoceras* was almost identical with Lamarck's descriptions of *Orthoceratites* (1799) and of the well-known lamellibranch genus *Hippurites* (1801). Dr. Stubblefield also mentioned a later note by Teichert & Miller (1938, *Amer. J. Sci.* **35** : 143–144) pointing out that the first author to use *Orthoceras* exclusively for cephalopods was Deshayes (1831) in connection with the single species *O. simplex* from the " terrain de transition " of Belgium. Dr. W. G. van Leckwijk, of Brussels, kindly tells me (*in lit.* 10.2.59) that this species is unknown and that its name has never come into general use.

7. Dr. Stubblefield's own view on the general question was expressed as follows : " . . . You ask whether I think that confusion would result, either in systematic work or in the teaching of invertebrate zoology, if the name *Orthoceras* were transferred from the Mollusca to the Protozoa. I would reply that *Orthoceras* used as a name for a cephalopod is one of the few genera of fossils mentioned in Parker & Haswell's *Text-book of Zoology*, 1910 edition ; the name is similarly used in almost all the text-books of invertebrate Palaeontology ; I know of no exception. I would say also that a similar usage will be found in any text-book dealing with the general stratigraphy of the Palaeozoic rocks. In my opinion, the transference of this name to the Protozoa would create confusion, and, I am inclined to think, ridicule among those impatient of nomenclatorial matters. The name *Orthoceras* has given rise to such systematic terms as ' Orthoceroid ', ' Orthoceratid ' and ' orthocone ' ; these would presumably create confusion in the Protozoa and Cephalopod literature if a change were to be made. In conclusion, personally were I asked, I would prefer that a suspension of the rules be allowed and that *Orthoceras* (rather than *Orthoceros*) be retained for the well-known cephalopod ; in any case, with the present restriction of genera to those species close to the chosen type species, in systematic work the use of the name would be much more restricted than in the last century ; but *Orthoceras* would remain a useful, easily remembered name for the field geologist."

8. Dr. Spath, in a letter dated 4 September 1944, expressed the view that it would be unwise for the Commission to use the Plenary Powers in the present case at least until a type-species for *Orthoceras* had been validly selected. He

added that it was "probable that between 1758 and 1789 some earlier author, unknown to Miller or Teichert, used the name *Orthoceras* Breyn, 1732 (which was excellently figured) in a binary form " and that " the name *Orthoceras* as used in all modern text-books, is without exact meaning ; it is used as a synonym of ' orthocone ' or a straight nautiloid, and will continue to be so used, whatever the Commission may find, simply because it is so deeply embedded in geological literature ".

9. Dr. Miller, in a letter dated 19 September 1944, said that, in view of the developments which had taken place, the statement that he had put before Dr. Stiles in 1930 would need to be thoroughly revised, and he proposed to confer with Dr. Teichert on this subject as soon as his other commitments allowed.

10. The late Mr. Winckworth's application concerning the status of the generic names in Brünnich's *Zoologiae Fundamenta* was published in 1945 (see paragraph 1 above) and was illustrated by a facsimile reproduction of p. 246 of Brünnich's work, containing, among other things, the diagnosis of the new genus *Orthoceros*. Mr. Winckworth suggested that the close adherence by Brünnich to the descriptions given by Linnaeus in the 10th and 12th editions of the *Systema Naturae* made it possible to determine the species which he regarded as belonging to his genera. Brünnich, whose work consists of what would now be regarded as a series of simple keys, placed *Orthoceros* next to *Nautilus* Linnaeus, 1758, and by abstracting from the key, the description can be seen to be : " Testaceum, Univalve ; Multiloculare, Siphone interiori communicans, Spirale rotundatum ". Mr. Winckworth concluded that " the type must be one of the species numbered 240–249 in the section " Elongati erectiusculi " of the genus *Nautilus* Linnaeus, 1758 ", and added that he did not " think that *Nautilus orthocera* Linnaeus, 1758 (sp. no. 249) should be regarded as the type by absolute tautonymy, for Brünnich's work is not concerned with fossils ".

11. The publication of Mr. Winckworth's paper prompted Dr. Curt Teichert to write to the Commission in January 1946, and to comment as follows on Mr. Winckworth's suggestion for determining the species which should be regarded as having been originally included by Brünnich in his new genera : " To attempt to find out what species Brünnich might have had in mind when he established this and other generic names seems to be hopeless and irrelevant. The name *Orthoceros* is, therefore, available for any more or less straight, elongate, multilocular, univalve mollusc with an internal siphuncle. Since such forms are not known living, it cannot be said that Brünnich's work is not concerned with fossils. Teichert and Miller stated i.e. in the paper published in 1936 that the name *Orthoceros* had apparently never been used in connection with a specific name and that, therefore, according to Opinion 46, any species, for example *Orthoceratites regularis* Schlotheim, 1820, might be selected as the type-species of this genus. Teichert and Miller took care not to select *Orthoceratites regularis* Schlotheim formally as the type-species of *Orthoceros*. This procedure was suggested, and even recommended as a distinct possibility, but it was desired to test the feelings of palaeontologists first. In 1944, Ulrich, Foerste, Miller & Unklesbay (*Geol. Soc. Amer. Special Paper*

58 : 60) stated : 'The genotype of *Orthoceros* is *Orthoceratites regularis* Schlotheim . . . ', but it seems doubtful whether this pronouncement constitutes a valid act of 'selecting' the type-species. More probably it does not, because as it stands, the statement is incorrect; no type-species had been definitely chosen in 1944."

12. At that date it seemed clear, by virtue of the ruling given in *Opinion* 46, (a) that Ulrich, Foerste, Miller & Unklesbay had definitely referred the nominal species *Orthoceratites regularis* Schlotheim, 1820 to *Orthoceros*, (b) that this, which was the only species referred to the genus by those authors, was the first species to be so referred, and therefore (c) that their designation of that species as the type-species of *Orthoceros* was valid. After further correspondence, Mr. Hemming wrote to Dr. Teichert and Dr. Miller in January 1947 to ascertain whether, if the Commission accepted that view, the resulting addition of *Orthoceros* to the Official List with the species named as type-species would offer a satisfactory solution to the problem. The following statements are extracted from their replies : (a) *from Dr. Miller's letter dated* 8 *February* 1947 : " I believe that it would be very desirable for the Commission to place the generic name *Orthoceros* Brünnich, 1771, on the *Official List of Generic Names in Zoology* and establish as its type-species *Orthoceratites regularis* Schlotheim, 1820. Such procedure would, as you anticipated, eliminate the need for any action to be taken on the application which in 1930 I submitted to the Commission through the late Dr. C. W. Stiles." (b) *from Dr. Teichert's letter dated* 11*th March* 1947 : " Your interpretation of the position with regard to the name *Orthoceros* Brünnich, 1771, is quite correct. There is no doubt in my mind that Brünnich's names are valid names and therefore that no special action is required to give them official standing. The case of *Orthoceros* is a special one, because it is a genus without a type-species. The suggestion of Teichert & Miller to select *Orthoceratites regularis* Schlotheim, 1820, as the type-species still stands and it would be a good thing if the Commission finalised this choice."

13. No further advance was made with the case before the Commission met in Paris in July 1948, when it was decided (see paragraph 1 above) to render an *Opinion* stating that Brünnich's generic names in the *Zoologiae Fundamenta* (1771) are available names. The Commission next considered each of the new names involved. Mr. Hemming stated that Mr. Winckworth maintained his former view that *Orthoceros* ought to be suppressed under the Plenary Powers on the ground that Brünnich had not dealt with fossils in the work in question ; he drew attention to the contrary view expressed by Dr. Teichert and Dr. Miller and suggested that a decision should be deferred until the views of palaeontologists were more fully known. The Commission accepted this suggestion and asked Mr. Hemming to prepare a report on the proposed consultations as quickly as possible, for submission to the Commission (*Bull. zool. Nomencl.* **4** : 312–313).

14. Acting under the decision recorded in the previous paragraph, Mr. Hemming proceeded to consider (i) what was the position of the generic name *Orthoceros* Brünnich, 1771 under the Code as amended by the Paris (1948) Congress ? and (ii) was this position such as would meet the general wishes

of palaeontologists by promoting stability of nomenclature in nautiloid cephalopods ?

15. The first question finds its answer in the decision of the Commission at at its Paris meeting to recommend the addition of a provision to the *Règles* stating (*Bull. zool. Nomencl.* **4** : 159–160) "that where, prior to 1 January 1931, a generic name was published for a genus established (a) with an indication, definition or description, (b) with no nominal species distinctly referred to it, the first nominal species to be subsequently referred to it by the same or another author is to be deemed to have been an originally included species and that species automatically becomes the type-species of the genus in question ", and to cancel the decisions in Opinion 46, other than the decision just recorded. At a subsequent meeting (*ibid.* : 346) the Commission recommended the addition of words to that provision to cover the case in which, on the first occasion when any nominal species were referred to such a genus, two or more species were so referred. These recommendations were approved by the Section on Nomenclature and by the Congress. The effect of these decisions on the generic name *Orthoceros* Brünnich, 1771 is that its status is exactly what it had before been supposed to be by Mr. Hemming (see paragraph 12 above), namely that *Orthoceratites regularis* Schlotheim, 1820 was the type-species of that genus by monotypy through the designation by Ulrich, Foerste, Miller & Unklesbay in 1944.

16. The next point to be considered was whether the name *Orthoceros* was subject to automatic correction by reason of having been incorrectly formed. The Rev. Professor L. W. Grensted (Consulting Classical Adviser to the Commission) pointed out that the word " orthoceros ", like the word " rhinoceros ", is a correctly formed Greek adjective, and that ὀρθόκερως actually occurs as an adjective in classical Greek. He went on to say that the adjectival form ὀρθόκερως (orthoceros, straight-horned) and the substantive form ὀρθόκερας (orthoceras, straighthorn) are both equally correct from the point of view of Greek word-formation. The Latin words used as generic names are here formed by direct transliteration from the Greek. The word " orthocera ", on the other hand, is not a transliteration (for no such word is possible in Greek), but a latinisation, and must be treated as a purely Latin (or Neo-Latin) word from the grammatical point of view, as which it is perfectly acceptable as a generic name. It is therefore clear that the generic name *Orthoceros* Brünnich, 1771 is not subject to correction by reason of having been incorrectly formed in any way.

17. It must here be pointed out that, under the Law of Homonymy as amended at Copenhagen in 1953 (*Copenhagen Decisions zool. Nomencl.* : 78 paragraph 152), the generic names *Orthoceros*, *Orthoceras* and *Orthocera* are not homonyms of one another, but must be treated as separate available names.

18. In considering the second of the two questions referred to in paragraph 14, it is sufficient in the first instance to recall what has been said in earlier paragraphs of this report, namely that Dr. Teichert and Dr. Miller both held the view that the group of species formerly known by the generic name *Orthoceras*, should in future be known by the generic name *Orthoceros* Brünnich, 1771, and that that nominal genus should have as its type-species *Orthoceratites*

regularis Schlotheim, 1820 (paragraph 12 above): and that Dr. Stubblefield and the late Dr. Spath held that means should be found to preserve the generic name *Orthoceras* for use in cephalopods, since the name itself and morphological and systematic terms derived from it are deeply embedded not only in systematic literature, but also in general textbooks of zoology, palaeozoology and stratigraphy and in the current language of field-geologists. They added that, in their separate opinions, *Orthoceras* would continue to be used whatever the Commission might decide (paragraphs 7 and 8 above).

Part 2. The Present Situation

19. The examination of the *Orthoceros/Orthoceras* problem had reached the position outlined in the preceding paragraphs when, in November 1958, I reopened the file in the hope of bringing this long-standing case to a speedy conclusion. Three points immediately came to mind as calling for remark. The first of these is that there is nothing surprising in the apparent wide discrepancy of usage of the name *Orthoceras* for both nautiloid cephalopods and foraminifera. Linnaeus himself (*Syst. Nat.* ed. 10, 1758) had described foraminifera and cephalopods simultaneously under the generic name *Nautilus*, and the view that foraminifera were minute cephalopods prevailed at least until the 1840's (*e.g.* d'Orbigny, 1835–47, *Voyage dans l'Amérique méridional*). Fleming (1828, *A History of British Animals*) divided the genus *Orthocera* into two groups, corresponding approximately to recent foraminifera and fossil cephalopods respectively. Thus it is possible to claim that the intentions of an early author would be treated with equal respect, whether a cephalopod or a foraminiferan type species were used as a means for giving objective definition to any of the generic names *Orthocera, Orthoceras* or *Orthoceratites*.

20. The second point is that many hundreds, and possibly thousands of generic names in fossil cephalopods end in -ceras, to the point where any name with that termination is instinctively thought of by a palaeontologist or a field geologist as a cephalopod name. Thus, while the adoption of *Orthoceros* in place of *Orthoceras* would present little or no difficulty to specialist workers in fossil cephalopods, such a change is pre-eminently one of the kind which causes workers in applied palaeontology to regard "nomenclature" as a mystic practice beyond normal understanding and, as such, best ignored. It is, for all practical purposes, certain that such workers, who are the principal users of the name *Orthoceras* and of the words of various intention derived from it, would ignore any decision of the Commission to render the name *Orthoceras* unavailable in fossil cephalopods.

21. The third point is one that arises out of the last, and is connected with the arguments presented in paragraph 18 above by Dr. Stubblefield and the late Dr. Spath. The group of straight, elongate nautiloids generally known as *Orthoceras* are, and have for many decades been, considered as a primitive or even ancestral group, from which the far more numerous spirally coiled cephalopods are held to have descended. Thus, students of the evolutionary process are apt to find, in any work which refers to the evolution of cephalopods, that a fundamental position is allotted to a group denoted by the name

Orthoceras. From being quoted in this sort of context, the name has acquired wide and long-established currency in the teaching of palaeozoology and in books of a semi-popular character on the history of animal life ; in which there are few episodes more dramatic than the rise and fall of the Cephalopods.

22. It is thus clear that there are strong reasons of an empirical kind why the Commission should take the necessary steps to preserve the generic name *Orthoceras* as an available name in cephalopods. In view, however, of Dr. Miller's statement (see paragraph 2 above) that the name should properly be used in the foraminifera, I thought it necessary to enquire of workers in that group whether they recognised the name as the valid name of a genus of foraminifera or not. The replies received, from which quotations are given in Annexe 1 below, show that *Orthoceras* is not so regarded, and that workers in foraminifera would not only strongly oppose its adoption in their group, but would also, as palaeontologists with a wider interest in the subject, emphatically wish that name to be preserved in its accustomed sense. While these enquiries were proceeding, I examined personally the circumstances surrounding the generic name *Orthoceras* Bruguière, 1789 and found these to be different from what they had been stated in good faith to be by Dr. Miller. The facts are set out in the following paragraph.

23. The status of the name *Orthoceras* Bruguière, 1789 (see paragraph 2 above) under the Code is made clear by a chronological statement of the events connected with the name :

1789. Bruguière opened the volume of the *Ency. méth.* on " Vers, coquilles et polypiers " with a "Tableau systématique" setting out his classification and giving diagnoses of the genera and their species as far as the letter " C ", but he died (in 1799) before publishing any further part of the work, which was continued under the supervision of Lamarck.

1799. Lamarck (*Mém. Soc. Hist. nat. Paris* **1** : 80) proposed the genus *Orthocera* with *Nautilus raphanus* Linnaeus, 1758 as type species by monotypy. (The generic name was an invalid homonym of *Orthocera* Modeer, 1789.)

1816. A fascicle of plates of the *Tableau ency. méth.* including pls. 391–488 was issued under Lamarck's supervision. This included a sixteen-page " Liste des objets représentés dans les planches de cette livraison " (attributed to [Lamarck], [1816] by Sherborn & Woodward, 1906, *Ann. Mag. nat. Hist.* (7) **17** : 577) in which figs. 2 and 3 of pl. 465 are listed as "*Orthocera raphanus* " and "*Orthocera legumen* ". The two points to note in this reference are, first that the generic name used is *Orthocera* (i.e. of Lamarck, 1799), not *Orthoceras* ; and secondly, that the plates of this fascicle, with the accompanying " Liste ", were issued in advance of their related text.

1822. Lamarck redescribed his genus *Orthocera* in vol. 7 of his *Hist. nat. Anim. s. Vert.* and referred six species to it, including *Orthocera raphanus* (: 593) and *Orthocera legumen* (: 595). There is no doubt that Lamarck is here using his own generic name of 1799.

1824. Bory de St. Vincent (*Tabl. ency. méth.*) published a new set of explanations of the plates published in 1816, in which pl. 465, figs. 2 and 3 are explained as "*Orthocera raphanus* Lamk. VII. 593" and "*Orthocera legumen* Lamk. VII. 595". The references are to the *Hist. nat. Anim. s. Vert.* quoted above, and the genus concerned is not *Orthoceras* Bruguière, 1789, but *Orthocera* Lamarck, 1799.

24. It does not appear that Bruguière's genus *Orthoceras* was ever dealt with in the text of the work in which the name was first published. In volume 3 of the "Vers" in the *Ency. méth.*, written by G. P. Deshayes and published in 1832, the following appears on p. 627 under *Nodosaria* : "On ne peut trop savoir quelle a été l'opinion de Bruguière à l'égard de ce genre : parmi le petit nombre de genres qu'il a démembrés des Nautiles de Linné, il semble que ce seroit plutôt à celui qu'il a nommé Orthocère qu'il appartiendroit qu'à tout autre." The difficulty in interpreting this statement lies in the fact that the French vernacular word "Orthocère" was generally used as the equivalent of *Orthocera* rather than of *Orthoceras* ("Orthocérate"), but it appears that Deshayes considered *Orthoceras* Bruguière as representing a genus of foraminifera, whereas Dr. Cox, in his application relating to *Hippurites* (p. 000 below) considers that the description accompanying the name might well apply to a Rudistid lamellibranch, and Dr. Eames has remarked to me that that description could not possibly apply to any known species of foraminifera. Later (: 673), Deshayes remarks : "Il faut se souvenir enfin que, dans quelques méthodes, toutes ces choses si diverses, portant des noms à peu près semblables, [i.e. *Orthocera*, *Orthoceras*, *Orthoceratites*] sont confondues quelquefois dans un seul genre, et quelquefois dans une même famille : cette famille, pour augmenter la confusion sans doute, porte aussi le nom d'Orthocères ou d'Orthocérées. Pour éviter une telle confusion, nous adoptons complètement le genre Nodosaire de M. d'Orbigny ; nous adoptons également dans son entier le genre Orthocérate de M. Sowerby, nommé à tort Orthocère par M. d'Orbigny, et nous rejetons tout le reste comme nuisible à la science par las confusion extrême que cela y apporte." It is clear from these two passages that Deshayes regarded *Orthoceras* Bruguière as a *nomen dubium* and that he proposed to attribute that name to Sowerby, who had in fact used *Orthocera* for straight nautiloid cephalopods. It is also clear that Deshayes did not attribute any nominal species to Bruguière's genus.

25. The generic name *Orthoceras* was used, apparently as a new name and without citation of any earlier author, by the following : Batsch, A. I. G. C., 1791, *Sechs Kupfertafeln mit Conchylien des Seesandes*, in relation to fourteen named species of foraminifera ; Spalovsky, J. J. N. A., 1795, *Prodromus in Syst. nat. Hist. Test.* in connection with one named species of foraminifera ; Schrank, F. von P. von, 1796, *Samml. nat. phys. Aufsatz*, for a dipteran insect ; Perry, G., 1811, *Conch. nat. Hist. Shells*, in relation to a named foraminiferan and a doubtful organism ; Blainville, H. M. D. de, 1825, *Man. Malac.*, for two straight nautiloids and four foraminifera ; Deshayes, G. P., 1831, *Descr. Coquilles caract. Terrains*, for a straight nautiloid ; and Phillips, J., 1836, *Ill. Geol. Yorks.* for eighteen species of straight nautiloids. Subsequent nineteenth century authors all used the name for straight nautiloids and attributed the name to the pre-Linnean author Breyn, 1732, sometimes spelt Breynius. No reference has anywhere been found prior to that mentioned in the next

paragraph that could be construed as the attribution of any nominal species to *Orthoceras* Bruguière, 1789.

26. It has been explained in paragraphs 4 to 15 above how it was thought that *Orthoceros* Brünnich, 1771 could, by the designation of a suitable type-species, be used in place of *Orthoceras* auctorum, and how *Orthoceratites regularis* was so designated by Ulrich, Foerste, Miller & Unklesbay in 1944. This same treatment had, however, already been given to *Orthoceras* Bruguière, 1789 by Miller, Dunbar & Condra in 1933, although it had been rejected by Teichert & Miller (1936) on the ground that Schlotheim's species did not come under Bruguière's generic diagnosis in the terms of Opinion 46, in spite of the efforts made by Miller, Dunbar & Condra to show that that requirement was in fact met. There is no doubt that, under existing rules, the action taken by those authors in 1933 is valid and definitive, for they were the first authors to refer any nominal species to *Orthoceras* Bruguière, 1789, and the fact that only a single species (*Orthoceratites regularis* Schlotheim, 1820) was so referred makes that species automatically the type-species, even if the authors concerned had not expressly stated this to be the case. *Orthoceros* Brünnich, 1771, first defined in terms of a nominal species by Ulrich and others in 1944, is thus a senior objective synonym of *Orthoceras* Bruguière, 1789, and it is suggested that the Commission should use its Plenary Powers to suppress the former in the interests of conserving *Orthoceras* in its accustomed sense.

27. The statements made in the preceding paragraph are made on the basis of an extensive search of the literature and are true so far as is known. Nevertheless, the literature on orthocone nautiloids is extensive and world-wide, and it is possible that some work may have been overlooked in which species were definitely referred to *Orthoceras* Bruguière, 1789 prior to the work of Miller, Dunbar & Condra, 1933 referred to. In order to place the interpretation of *Orthoceras* on a finally secure basis, therefore, the Commission is asked to set aside, by using its Plenary Powers, all designations of a type-species for that genus made prior to the ruling now requested and, having done so, to designate *Orthoceratites regularis* Schlotheim, 1820 as the type species.

28. Dr. Teichert has kindly drawn my attention to a recent paper in Russian by S. G. Balashov (1956, *Ezhegodnik Vsesoyusnogo Obshsch.* **15** : 223–241). No full translation of the extensive historical discussion in this paper is at present available, but it seems clear that Balashov concludes that *Orthoceros* Brünnich, 1771 is to be treated as a synonym of, and emended to, *Orthoceras*, and that the latter name is to be given priority as from 1771. If this is a correct reading of the work, then *Orthoceras* Balashov, 1956 is an invalid emendation of *Orthoceros* Brünnich, 1771.

29. With regard to the type-species of *Orthoceras*, it may be pointed out that the taxonomic concept represented by the name, which at one time included all Palaeozoic straight nautiloids, has been progressively restricted by the establishment of other nominal genera for parts of the broader idea. It is therefore important that, if the generic name is to be stabilised by reference to a cephalopod species, the use of those other generic names should not be disturbed. Owing to the comparatively recent origin of the discussion of the history and status of the name, this aspect of the question is well covered, for

Orthoceratites regularis Schlotheim, 1820, which, as shown in paragraph 26 above, is the type-species of the genus under the Rules, is considered by specialists in the group to be typical of the genus in the restricted sense. This is shown by the fact that it was designated as the type-species not only by Miller, Dunbar & Condra, 1933, but also by Ulrich, Foerste, Miller & Unklesbay, 1944 (for *Orthoceros*) and by Balashov, 1956. It is clear also that Teichert & Miller, 1936 regarded the species in the same light. Moreover, the species was fully described and illustrated by Troedsson (1931, *Lunds Univ. Årsskr.* N.F. Avd. 2, 28) who selected a lectotype from Schlotheim's collection. No special action is therefore needed to provide *Orthoceras*, if accepted as a cephalopod genus, with a type-species in harmony both with current usage and with the Rules.

30. At the family-group level, it is found that names have been founded both on *Orthoceras* and on *Orthoceros*. It is proposed to disregard the French vernacular word " Les Orthocérées " on account of the doubtful uses of this name for a suprageneric unit, and to accept in its place the undoubted family-name ORTHOCERATIDAE McCoy, 1844 (*Synopsis carb. Fossils Ireland* : 6) which, as Dr. W. H. C. Ramsbottom (Geological Survey & Museum, London) kindly informs me, is the oldest family-group name based on *Orthoceras* and expressly used to designate a nominal family of nautiloid cephalopods. It is therefore proposed that this name be placed on the Official List. The only family-group name based on *Orthoceros* is ORTHOCEROTIDAE Teichert & Miller, 1936, and if the proposal made in paragraph 26 above to suppress *Orthoceros* under the Plenary Powers is accepted, then the family-name based on that generic name will be automatically rejected and can be placed on the Official Index.

31. At this point I took up the examination of a reference in Teichert & Miller (1936) to the fact that the generic name *Orthoceratites* Lamarck, 1799 was apparently identical with the non-binominal *Hippurites* Picot de la Peyrouse, 1781, and possibly also with the widely-used available name *Hippurites* Lamarck, 1801. This question was entrusted to Dr. L. R. Cox (British Museum (Natural History), London), who found that this was indeed the case. He has kindly prepared an application (pp. 25–26 below) for the suppression under the Plenary Powers of *Orthoceratites* Lamarck, 1799 so as to conserve *Hippurites* Lamarck, 1801.

32. In order to ascertain the position of the names mentioned in Foraminifera, I consulted Dr. F. E. Eames and Dr. F. T. Banner (British Petroleum Co. Ltd., Sunbury-on-Thames, England) and Dr. A. H. Smout (Iraq Petroleum Co. Ltd., London). All were of the opinion that the names *Orthocera* and *Orthoceras* constituted potential threats to the stability of generic names in general use and that steps should at once be taken to remove this threat. Extracts from their letters are given in Annexe 1 below.

33. The generic name *Orthocera* was first published as an available name under the Code by Modeer, 1789 (*Illustr. quaedam in R. D. Ambr. Soldani opus egreg. Saggio Orittograffico dictum*). This work was first published as a part of Soldani's *Testaceogr. ac Zoophytogr. parvae et microsc. tomus primus*, which is a non-binominal work. Modeer's contribution, however, is strictly binominal and was re-issued in 1791 in *Nova Acta Acad. Caes. Leop.-Carol.* 8 (Appendix) :

85–94. The following species were expressly and unambiguously referred to the genus by Modeer: *Orthocera crispata* Modeer, *Nautilus orbiculus* Forskål, 1785, *Nautilus raphanistrum* Linnaeus, 1758, *Nautilus obliquus* Linnaeus, 1758, *Orthocera armilla* Modeer, *Nautilus radicula* Linnaeus, 1758, *Nautilus raphanus* Linnaeus, 1758, *Nautilus legumen* Linnaeus, 1758 and *Orthocera pupa* Modeer. No type-species was designated or indicated and an additional species cited as " *Nautilus rapistrum* Linnaeus . . . mihi *Orthocera* vel *Arthrocena rapistrum* " is not eligible for selection as type-species since it was referred to the genus only with doubt. (Modeer's work consists of comments on various specimens figured by Soldani in his *Saggio Orittograffico* rather than of a systematic description of new species. The specific name " *rapistrum* " is not known in Linnaeus's works.) Galloway (1933, *Man. Foram.* : 453) selected *Orthocera sipunculus* Modeer, 1796, but this is invalid because the species was not among those originally included in the genus. Dr. Banner informs me (*in lit.* 27 November 1958) that no valid type-selection is known for *Orthocera* Modeer, 1789.

34. It would clearly be desirable to dispose of the unwanted generic name *Orthocera* Modeer, 1789, by finding out to what genera the species referred by him to that genus are now attributed and by safeguarding those generic names from any threat to which they are liable so long as *Orthocera* remains an available name by placing them on the Official List. However, it appears from correspondence with Dr. Banner and Dr. Smout that certain of the species in question have in the past been referred to genera whose taxonomic validity is not unequivocal, and that two or more generic names may be currently in use for a taxon containing one of Modeer's species. Moreover, it is by no means easy in the present state of knowledge to find out whether valid type-designations have been made for these genera, nor to be sure that the strict application of the Rules in these cases would meet with general approval. This situation, while regrettable, demands lengthy investigation and much help from specialists in foraminifera, and it seems better, therefore, not to delay the seeking of a permanent settlement of the main *Orthoceras* problem while the collateral questions are being thoroughly explored. The only other method whereby the generic name *Orthocera* Modeer, 1789, can be effectively disposed of is by finding a nominal genus of undisputed validity of which the type-species under the Rules is (a) one of the species placed in *Orthocera* by Modeer in 1789, and (b) in harmony with the accustomed use of the generic name in question. *Orthocera* Modeer, 1789 can thus be rendered a senior objective synonym of a generic name in general current use and, as such, amenable to suppression for priority but not for homonymy through the use of the Plenary Powers.

35. A nominal genus suitable to this purpose exists in *Nodosaria* [Lamarck], [1816] (*Tabl. ency. méth.*, 16-page " Liste des objets " : 13). This nominal genus was proposed with two included species, namely, *Nautilus radicula* Linnaeus, 1758 and *Nodosaria clavulus* Lamarck. *Nautilus radicula* Linnaeus, 1758 was designated as the type-species by Children in 1823 (*Lamarck's genera of shells translated from the French* : 113) and the genus, which is and always has been universally employed, is used in this sense. The following species

included in *Orthocera* Modeer, 1789, are currently placed in *Nodosaria* : *Orthocera armilla* Modeer, 1789 (by some authors referred to *Dentalina* d'Orbigny, 1826) ; *Nautilus obliquus* Linnaeus, 1758 (with some doubt) ; *Nautilus radicula* Linnaeus, 1758 ; and *Nautilus raphanistrum* Linnaeus, 1758. I therefore now designate *Nautilus radicula* Linnaeus, 1758 as the type-species of *Orthocera* Modeer, 1789 and request the Commission to use its Plenary Powers to suppress that generic name for the purposes of the Law of Priority but not for those of the Law of Homonymy.

36. Modeer used his own generic name *Orthocera* in 1791, in the re-issue of his 1789 work already mentioned, and in 1796 (*K. Vetensk.-Akad. nya Handl.* **17** : 63) for foraminifera and for straight nautiloids. The name was also used by Lamarck, 1799 (*Mém. Soc. Hist. nat. Paris* **1** : 80), for foraminifera ; J. Sowerby, 1812 (*Min. Conch.* **1** : 127) for straight nautiloids ; Fleming, 1815 (*Ann. Phil.* **5** : 201–206) for nautiloid cephalopods and one species of foraminifera ; and Blainville, 1828 (*Dict. Sci. nat.* **36** : 485) for foraminifera. No usage of *Orthocera* later than 1828 (Blainville, *op. cit.* ; Fleming, *Hist. brit. Anim.*) has been traced. Uses of the generic name *Orthoceras* in foraminifera have been listed in paragraph 25 above.

37. The Rules do not give precise guidance as to the treatment of an existing generic name when this is cited without reference to any previous author. In the vast majority of such cases there is no reasonable doubt that the name is being used in its existing sense, and it would not be necessary to consider every use of, for example, *Homo* or *Musca* as the homonymous proposal of a new generic name merely because no explicit reference was made to " Linnaeus, 1758 ". Similarly, it is generally obvious when a generic name is being used as an invalid homonym, for this will usually take place in a group far removed taxonomically from that in which the name is valid. The names involved in the present case, however, do not present themselves in so clear a light. This is partly due to the fact that both *Orthoceras* and *Orthocera* had come into current use in pre-Linnean times, so that their meaning was clear, in a generalised way, to any late-eighteenth-century naturalist whether they were referred to any of several previous authors or not. In the case of *Orthoceras*, for example, there is no evidence that Batsch (1791) knew of the existence of this name in Bruguière's work of 1789, for he made no reference to it, and the species which he referred to the genus have no relevance to the generic description provided by Bruguière. Neither Spalovsky (1795) nor Perry (1811), who both used *Orthocera* for foraminifera, made any reference to Batsch, nor did they include any of the species named by him in the genus. Schrank's usage of the name for an insect in 1796 is clearly homonymous in the ordinary sense of the word. Blainville (1825) and Deshayes (1831) used the name in different senses from each other and from any previous author, and Phillips (1836) clearly considered it to be in part equivalent to *Orthocera* Fleming (1815, 1828), for he included some of Fleming's species of *Orthocera* in *Orthoceras*. In order to prevent some later author from challenging a ruling on the lines here proposed for *Orthoceras* Bruguière, 1789, on the grounds that these later uses of the name had been wrongly regarded as usages of Bruguière's generic name, the Commission is asked to rule that those uses are invalid by reason

of being junior homonyms of *Orthoceras* Bruguière, 1789. This course will not, however, be necessary in regard to the uses of *Orthocera* after Modeer, 1789, because those names will automatically be rendered invalid if the proposal made in paragraph 35 above to use the Plenary Powers to suppress that name for priority but not for homonymy is accepted.

38. The last point calling for attention in the present problem concerns the alleged generic names *Orthocerata* Soldani, 1780 and *Orthoceratia* Soldani, 1780 (*Saggio Oritt.* : 107) listed by Sherborn in his *Index gen. sp. Foram.*, 1896 : 287–289. These alleged names were used as Latin plural nouns by a non-binominal author in a non-binominal work, and as such have no status in zoological nomenclature.

39. The action which the International Commission on Zoological Nomenclature is therefore asked to take is as follows :—

(1) use its Plenary Powers :
  (a) to set aside all designations of a type-species for the nominal genus *Orthoceras* Bruguière, 1789 made prior to the ruling now asked for and, having done so, to designate *Orthoceratites regularis* Schlotheim, 1820 as the type-species of that genus ;
  (b) to suppress the following generic names for the purposes of the Law of Priority but not for those of the Law of Homonymy :
    (i) *Orthoceros* Brünnich, 1771 (an unused senior objective synonym of *Orthoceras* Bruguière, 1789) ;
    (ii) *Orthoceras* Balashov, 1956 (an invalid emendation of *Orthoceros* Brünnich, 1771) ;
    (iii) *Orthocera* Modeer, 1789 (an unused senior objective synonym of *Nodosaria* [Lamarck], [1816]) ;

(2) rule that the following generic names are invalid by reason of being junior homonyms of *Orthoceras* Bruguière, 1789 : (a) *Orthoceras* Batsch, 1791 ; (b) *Orthoceras* Spalovsky, 1795 ; (c) *Orthoceras* Schrank, 1796 ; (d) *Orthoceras* Perry, 1811 ; (e) *Orthoceras* Blainville, 1825 ; (f) *Orthoceras* Deshayes, 1831 ; (g) *Orthoceras* Phillips, 1836 ;

(3) place the following generic names on the Official List of Generic Names in Zoology :
  (a) *Orthoceras* Bruguière, 1789 (gender : neuter), type-species, by designation under the Plenary Powers in (1)(a) above, *Orthoceratites regularis* Schlotheim, 1820 (Class Cephalopoda, Order Nautiloidea) ;
  (b) *Nodosaria* [Lamarck], [1816] (gender : feminine), type-species, by selection by Children, 1823, *Nautilus radicula* Linnaeus, 1758 (Class Rhizopoda, Order Foraminifera) ;

(4) place the following specific names on the Official List of Specific Names in Zoology :
  (a) *regularis* Schlotheim, 1820, as published in the binomen *Orthoceratites regularis* (type-species, by designation under the Plenary Powers in (1)(a) above of *Orthoceras* Bruguière, 1789) ;
  (b) *radicula* Linnaeus, 1758, as published in the binomen *Nautilus*

radicula (type-species, by selection by Children, 1823, of *Nodosaria* [Lamarck], [1816]) ;

(5) place the family name ORTHOCERATIDAE McCoy, 1844 (type-genus : *Orthoceras* Bruguière, 1789) on the Official List of Family-Group Names in Zoology ;

(6) place the following generic names on the Official Index of Rejected and Invalid Generic Names in Zoology :
  (a) the three generic names suppressed under the Plenary Powers in (1)(b) above ;
  (b) the seven generic names declared in (2) above to be invalid junior homonyms of *Orthoceras* Bruguière, 1789 ;
  (c) the following junior homonyms of *Orthocera* Modeer, 1789 : (i) *Orthocera* Lamarck, 1799 ; (ii) *Orthocera* J. Sowerby, 1812 ; (iii) *Orthocera* Fleming, 1815 ; (iv) *Orthocera* Blainville, 1828 ;
  (d) the following reputed generic names published in a non-binominal work by a non-binominal author : (i) *Orthocerata* Soldani, 1780 ; (ii) *Orthoceratia* Soldani, 1780 ;

(7) place the family-name ORTHOCEROTIDAE Teichert & Miller, 1936 (rendered invalid by the suppression under the Plenary Powers in (1)(b) above of *Orthoceros* Brünnich, 1771) on the Official Index of Rejected and Invalid Family-Group Names in Zoology.

ANNEXE 1

Extracts from letters received

Dr. F. T. Banner, 27 *November* 1958.—The name *Orthocera* does not seem to have been applied to any Foraminifera since the middle of the nineteenth century . . . It seems highly probable that (a) no type-species has been validly designated for *Orthocera* Modeer, 1789, and this genus is still potentially valid and a potential nuisance unless suppressed ; (b) *Orthocera* Lamarck is a homonym of *Orthocera* Modeer ; (c) *Orthoceras* has not been used validly for any group of Foraminifera, and (d) there is a strong case for the suppression of *Orthocera* on the grounds of stability.

Dr. F. E. Eames, 9 *January* 1959.—Although *Orthoceras* was used as a generic name for foraminifera in the eighteenth century, it has for many years been used for long, straight, nautiloid cephalopods, and in this sense it has acquired, and still enjoys, wide usage in stratigraphical palaeontology and field geology, and in the teaching of palaeontology and evolution. As a specialist in foraminifera, I strongly oppose any attempt to transfer the name to that group ; and as being concerned in my work with fossils of many groups, I use the name in its accustomed sense not only from force of teaching and habit, but also because I know that my colleagues will immediately understand what I mean by it. I therefore wish to support the proposal to conserve the generic name *Orthoceras* in the sense in which it has been used during the last hundred years or more.

Dr. Curt Teichert, 19 *January* 1959.—I was very glad to have my attention called to the modification of Opinion 46. This, if applied retroactively, as I suppose it must be, invalidates entirely all arguments presented by Miller and myself in 1936 against the possibility of selecting a cephalopod as type-species of *Orthoceras* Bruguière . . . I have reviewed again all the relevant literature from the 1920's and early 1930's and I find that Miller, Dunbar & Condra (1933 : 31) very definitely and unambiguously designated *Orthoceratites regularis* Schlotheim as the genotype of *Orthoceras* Bruguière.

Dr. Teichert, 27 January 1959.—It looks to me now as if final settlement can only be achieved by appeal to the Commission. I would favour an appeal to the Commission to uphold Miller, Dunbar & Condra's selection of *Orthoceratites regularis* as type-species of *Orthoceras* Bruguière. Confirmation of this choice is now possible since the part of Opinion 46 requiring that the type-species must come " under the description as originally published " has been rescinded. As far as I am aware no type-species for *Orthoceras* Bruguière had been selected prior to 1933 nor had it ever been stated that Bruguière was technically the author of that genus. As late as the late 1920's it was customary to credit *Orthoceras* to Breyn, a non-Linnean author. It may, therefore, be assumed that references of *Orthoceras* prior to the publication of Miller, Dunbar & Condra's paper, other than those concerned with *Orthoceratites regularis*, may be regarded as junior homonyms of Bruguière's genus. If you concur in this opinion and would like to prepare a statement of the case for submission to the I.C.Z.N., I shall be very glad to support the application. I am definitely not in favour of emending *Orthoceros* Brünnich and I fully concur in the reasons stated by you against such action [see paragraph 16 above].

Dr. R. H. Cummings (*Department of Geology, Glasgow University*), 20 *March* 1959.—I have discussed this matter with Professor George and Dr. Weir. Both feel as strongly as I do on having the generic name *Orthoceras* placed on the Official List and reserved for the Cephalopoda.